

Citation:

Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *Am J Public Health*. 2007 Apr;97(4):667-75. Epub 2007 Feb 28.

PubMed ID: [17329656](#)

Study Design:

Systematic Review/Meta-analysis

Class:

M - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the association between soft drink consumption and nutrition and health outcomes.

Inclusion Criteria:

- The authors investigated the effects of sugar-sweetened beverages; diet and artificially sweetened beverages were noted only in certain cases for comparison purposes.
- They conducted a computer search through MEDLINE and PsycINFO using the key terms “soft drink,” “soda,” and “sweetened beverage.”
- They identified articles that assessed the association of soft drink consumption with 4 primary outcomes (energy intake, body weight, milk intake, and calcium intake) and 2 secondary outcomes (nutrition and health).
- They identified additional articles by searching each article’s reference section and the Web of Science database.
- In addition, they contacted the authors of each included article with a request for unpublished or in-press work, and they asked each author to forward our request to other researchers who might have relevant work.
- The searches yielded a total of 88 articles that were included in the present analysis.

Exclusion Criteria:

None specifically mentioned.

Description of Study Protocol:**Recruitment**

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Design: Systematic review/meta-analysis

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- The authors calculated average effect sizes (r values) using Comprehensive Meta-Analysis version x2 (Biostat, Englewood, NJ).
- In most cases, they entered data in the form in which they appeared in each individual study, including group means and standard deviations, correlation coefficients, t values, P values, and odds ratios and confidence intervals.
- In certain cases, it was necessary to manually calculate effect sizes. For example, when means for more than 2 groups were presented (e.g., low, moderate, and high soft drink consumption), they used the formulas for 1-way contrasts described by Rosenthal et al.
- In other cases, odds ratios were reported with uneven confidence intervals (as a result of rounding), and effect sizes were calculated directly from the odds ratio according to the method described by Chinn.
- The authors considered an effect size of 0.10 or less as small, an effect size of 0.25 as medium, and an effect size of 0.40 or above as large.

Data Collection Summary:

Timing of Measurements: not applicable

Dependent Variables

- Increased energy intake
- Increased body weight
- Displacement of nutrients
- Increased risk of chronic diseases

Independent Variables

- Soft drink consumption

Control Variables

Description of Actual Data Sample:

Initial N: 88 studies

Attrition (final N): 88 studies

Age: not reported

Ethnicity: not reported

Other relevant demographics:

Anthropometrics

Location: International studies

Summary of Results:

Key Findings

- Soft drink consumption was associated with an increase in energy intakes and body weight and decreases in milk and calcium intake.
- Soft drink consumption was associated with increase in sugar intake and decreases in starch and fiber intakes. Soft drink consumption was associated with decreased intakes of protein, fruit juice, fruit and riboflavin. Soft drink consumption was associated with an increased risk of several chronic diseases including type 2 diabetes.
- The overall effect size (r) across all studies for the relation between soft drink consumption and energy intake was 0.16 ($P < .001$). The average effect size of the association between soft drink consumption and energy intake across all cross-sectional studies was 0.13 ($P < .001$); The 5 longitudinal studies that were evaluated all reported positive associations between soft drink consumption and overall energy intake. The average effect size for these studies was 0.24 ($P < .001$).
- The overall effect size for studies examining the link between soft drink consumption and body weight was 0.08 ($P < .001$).
- The overall effect size for milk intake was -0.12 ($P < .001$). The overall effect size for calcium intake was -0.04 ($P < .001$).
- Overall associations (r values) of soft drink consumption with added sugar, fructose, and sucrose were 0.18, 0.36, and 0.23, respectively. Other studies revealed a negative association of soft drink consumption with intake of both dietary fiber ($r = -0.31$) and starch ($r = -0.27$).
- Soft drink consumption also was associated with decreased intakes of protein ($r = -0.14$), fruit juice ($r = -0.17$), fruit ($r = -0.09$), and riboflavin ($r = -0.12$), among others.
- Soft drink consumption was associated with type 2 diabetes, hypocalcemia and dental caries.

Average energy intake effect sizes for children:

- Overall: $r = 0.08$ (95% CI: 0.07, 0.09; $P < 0.0056$; $N = 13$)
- Cross-sectional: $r = 0.08$ (95% CI: 0.06, 0.09; $P < 0.0056$; $N = 10$)
- Longitudinal: $r = 0.09$ (95% CI: 0.05, 0.13; $P < 0.0056$; $N = 2$)
- Experimental: $r = 0.00$ (95% CI: -0.31 , 0.31; NS; $N = 1$)

Average energy intake effect sizes for adults:

- Overall: $r = 0.28$ (95% CI: 0.27, 0.30; $P < 0.0056$; $N = 19$)
- Cross-sectional: $r = 0.28$ (95% CI: 0.26, 0.30; $P < 0.0056$; $N = 2$)
- Longitudinal: $r = 0.29$ (95% CI: 0.27, 0.31; $P < 0.0056$; $N = 3$)
- Experimental (short): $r = 0.22$ (95% CI: 0.15, 0.29; NS; $N = 11$)

Average body weight effect sizes for children:

- Overall: $r = 0.03$ (95% CI: 0.02, 0.04; $P < 0.0056$; $N = 22$)
- Cross-sectional: $r = 0.03$ (95% CI: 0.01, 0.04; $P < 0.0056$; $N = 13$)
- Longitudinal: $r = 0.03$ (95% CI: 0.01, 0.04; $P < 0.0056$; $N = 7$)
- Experimental: $r = 0.29$ (95% CI: 0.22, 0.35; NS; $N = 2$)

Average body weight effect sizes for adults:

- Overall: $r = 0.11$ (95% CI: 0.10, 0.12; $P < 0.0056$; $N = 11$)
- Cross-sectional: $r = 0.06$ (95% CI: 0.05, 0.08; $P < 0.0056$; $N = 5$)
- Longitudinal: $r = 0.14$ (95% CI: 0.13, 0.16; $P < 0.0056$; $N = 3$)
- Experimental (long): $r = 0.15$ (95% CI: 0.05, 0.24; NS; $N = 5$)

Author Conclusion:

Available data indicate a clear and consistent association between soft drink consumption and increased energy intake. Given

the multiple sources of energy in a typical diet, it is noteworthy that a single source of energy can have such a substantial impact on total energy intake. This finding alone suggests that it would be prudent to recommend population decreases in soft drink consumption. The fact that soft drinks offer energy with little accompanying nutrition, displace other nutrient sources, and are linked to several key health conditions such as diabetes is further impetus to recommend a reduction in soft drink consumption.

Reviewer Comments:

- *Authors note that study design significantly influenced results: larger effect sizes were observed in studies with stronger methods (longitudinal and experimental vs cross-sectional studies).*
- *Several other factors also moderated effect sizes (e.g. gender, age, beverage type).*
- *Studies funded by the food industry reported significantly smaller effects than did non-industry-funded studies.*

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

1.	Will the answer if true, have a direct bearing on the health of patients?	Yes
2.	Is the outcome or topic something that patients/clients/population groups would care about?	Yes
3.	Is the problem addressed in the review one that is relevant to nutrition or dietetics practice?	Yes
4.	Will the information, if true, require a change in practice?	Yes

Validity Questions

1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described?	Yes
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes
4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issues considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes

8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	???

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